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ABSTRACT

High schools serving disadvantaged students typically lack the requisite information on students and their performance to identify and meet their needs. Most studies on the use of information by district-level administrators, principals, teachers, and other school staff are descriptive and focus on the thought processes of individuals or groups as they perform routine educational tasks, solve problems, and make decisions. Almost no studies have examined the relationship between information use and student outcomes. Educators appear to cope with imperfect data and time constraints by developing short-cuts to obtaining and interpreting information, or by making decisions based on outdated information. Innovative approaches to improving the gathering and use of information have emphasized the use of student assessment information to modify instructional techniques, the systematic examination of program characteristics and outcomes to solve problems, and the implementation of integrated computerized databases to organize information and make it accessible for analysis. The following guidelines for developing effective school information systems are offered: (1) the system must be closely linked to the various alternative courses of action that educators might pursue in their work; (2) the system must be based on the work roles of the school personnel who will use it; and (3) the resistance to accompanying changes in work roles must be overcome by integrating the new system into a broader goal, such as school restructuring. A list of 79 references is appended. (FMW)

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THE JOHNS HOPKINS UNIVERSITY

More Responsive High Schools, Student Information, And Problem Solving

Carolyn Riehl, Aaron M. Pallas

and

Gary Natriello

Report No. 12

March 1991

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More Responsive High Schools, Student Information, and Problem Solving

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Teachers College, Columbia University

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The Center

The mission of the Center for Research on Effective Schooling for Disadvantaged Students (**CDS**) is to significantly improve the education of disadvantaged students at each level of schooling through new knowledge and practices produced by thorough scientific study and evaluation. The Center conducts its research in four program areas: The Early and Elementary Education Program, The Middle Grades and High Schools Program, the Language Minority Program, and the School, Family, and Community Connections Program.

The Early and Elementary Education Program

This program is working to develop, evaluate, and disseminate instructional programs capable of bringing disadvantaged students to high levels of achievement, particularly in the fundamental areas of reading, writing, and mathematics. The goal is to expand the range of effective alternatives which schools may use under Chapter 1 and other compensatory education funding and to study issues of direct relevance to federal, state, and local policy on education of disadvantaged students.

The Middle Grades and High Schools Program

This program is conducting research syntheses, survey analyses, and field studies in middle and high schools. The three types of projects move from basic research to useful practice. Syntheses compile and analyze existing knowledge about effective education of disadvantaged students. Survey analyses identify and describe current programs, practices, and trends in middle and high schools, and allow studies of their effects. Field studies are conducted in collaboration with school staffs to develop and evaluate effective programs and practices.

The Language Minority Program

This program represents a collaborative effort. The University of California at Santa Barbara is focusing on the education of Mexican-American students in California and Texas; studies of dropout among children of recent immigrants are being conducted in San Diego and Miami by Johns Hopkins, and evaluations of learning strategies in schools serving Navajo, Cherokee, and Lumbee Indians are being conducted by the University of Northern Arizona. The goal of the program is to identify, develop, and evaluate effective programs for disadvantaged Hispanic, American Indian, Southeast Asian, and other language minority children.

The School, Family, and Community Connections Program

This program is focusing on the key connections between schools and families and between schools and communities to build better educational programs for disadvantaged children and youth. Initial work is seeking to provide a research base concerning the most effective ways for schools to interact with and assist parents of disadvantaged students and interact with the community to produce effective community involvement.

Abstract

Many high schools that serve disadvantaged students are not easily able to be responsive to their students' diverse academic and social needs. This paper examines current knowledge about the use of information in schools in order to asses whether schools might become more responsive by processing information differently. The paper reviews how information is used by district-level administrators, principals, teachers, and other school staff; presents examples of promising strategies of information use in schools; presents the implications of the review for educational practices, and suggests new directions for the use of information in schools.

Introduction

High schools serving disadvantaged students confront a distinctive problem in attempting to be more responsive to student needs. Disadvantaged students bring to their schools exceptionally diverse patterns of academic performance and behavior, as well as diverse, unfamiliar, and complicated social and economic backgrounds.

One consequence of this diversity is uncertainty. When educators know a great deal about students and their academic and social needs, or when they can predict students' needs with a high degree of accuracy, they can plan for the academic and social resources in the school to meet those needs. Moreover, when student needs are fairly uniform, the regular routines of the school may be sufficient for meeting student needs. We call such schools responsive, because they are successfully responding to students' needs. But schools serving disadvantaged students typically lack the requisite information on students and their performance to identify and meet these students' needs successfully. And because the needs of disadvantaged students are diverse and often unpredictable, it is difficult to establish routines for dealing adequately with student needs. Many high schools serving disadvantaged students, then, are not easily able to be responsive to students' academic and social needs.

One strategy for making high schools more responsive to the needs of disadvantaged students is to increase the school's capacity to process information on students (Natriello, McDill & Pallas, 1990). Obtaining and analyzing a wider range of information on students, at frequent time intervals, may help schools to identify students needs in time to do something about them and to select appropriate responses. However, the increased availability of information does not guarantee that school practices will change and that schools will become more responsive (Herman, 1987; Kennedy, 1982; Williams & Bank, 1984). The connection between information and action is a tenuous one, influenced by beliefs, habits, resources, and politics. Therefore, a degree of skepticism about this strategy is appropriate.

It is our aim in this paper to examine current knowledge about the use of information in schools, in order to assess whether schools might, in fact, become more responsive by processing information differently.

First, we review how information is used by district-level administrators, principals, teachers, and other school staff. Most of the research in this area is descriptive, focused on the thought processes of individuals or groups as they perform routine educational tasks, solve problems, and make decisions. Almost no research has examined the relationship between information use and student outcomes.

In the second section of the paper, we present examples of promising strategies for information use in schools. Again, while these examples may be based on sound principles of practice, there is scant evidence as yet of their effects on student learning. We conclude the paper by summarizing the implications of our review for educational practice, and suggesting new directions for the use of information in schools.

Studies of Existing Patterns of Information Use in Schools

The Use of Information by School Board Members and District-Level Administrators

School leaders outside of the school building (boards of education and district administrators) generally make planning and oversight decisions regarding school policy and practices, and provide overall management of the school system. Although curricular and instructional decisions and the monitoring of student achievement are under their purview, board members and superintendents spend relatively little time on these issues. The majority of superintendents' time is devoted to management issues surrounding personnel, fiscal affairs, and public relations, and board members rarely play a major role in decisions about educational innovations, often following the lead of the superintendent (Fullan, 1982). As is typical of school leaders at most levels, superintendents report that their days are spent reacting to problems, with very little time to think and plan (Fullan, 1982). They often must act in a charged, conflict-ridden political context, with many items competing for their attention. Performance information, including program evaluations and student achievement data, may not be their primary decision aid; there may not be adequate time to consider such information carefully, and other factors -- for example, value judgments -- may carry more weight.

Very little descriptive research has been done on how district-level school leaders use information in problem-solving, either in laboratory or natural settings. The available evidence indicates that the information needs of school board members and district-level administrators vary with the type of decision to be made, the importance of the decision to be made, and the amount of conflict surrounding the decision. For example, Newman, Brown, Rivers, and Glock (1983) asked school board members and district-level administrators to read vignettes of typical decision situations and describe how they would make decisions under such conditions. The more conflict-ridden a potential decision, the more informal information was desired by board members and administrators. Decision makers preferred talking to individuals informally before acting, especially the local district superintendent and individuals involved in the program or programs at issue. When asked specifically what kinds of information they would like to have when making decisions about curricular programs, over half of the respondents wanted opinions (from students, parents, teachers, etc.), while less than a third wanted outcome data from the program.

Administrators preferred program performance information much more than did school board members. In another study using simulation vignettes, Brown, Newman, and Rivers (1985) found that board members reported higher needs for information for "important" decisions, and that the opinions of others (most notably the district superintendent and persons directly involved in programs) were much more important to them than performance or outcome data.

This emphasis on informal and casually acquired information rather than quantitative performance data was also observed by Sproull and Zubrow (1981). These researchers studied district-level administrators' use of information about the performance of students, teachers, and administrators. They found that school systems regularly gave standardized tests to students and that administrators justified this activity as providing information for decisions about individual students, evaluations of instructional programs, end-of-year measurements of achievement, and reports to external agencies. However, although administrators believed that test results were useful to others within the school system, especially those involved with instruction on a day-to-day basis, they themselves rarely used test information as an impetus for action. Instead, administrators relied on other kinds of performance information, such as personal observations and reports from teachers. Many appeared to gather information in "an ad hoc and haphazard way"

(p. 66), without realizing the biases inherent in collecting information through an unsystematic sampling of all possible observations and conversations they might have.

No doubt part of the reason that school board members and district-level administrators do not always find formal, systematic information useful is that such information is rarely available in forms that allow them to use it as a basis for action. Although local school districts collect an extensive array of data on students, staff, and schools, they seldom organize and store this information so that it can be used for longitudinal, integrative, non-routine inquiries (Burstein, 1984). Nor are there good mechanisms for processing and transmitting information to district-level administrators or school board members in formats that can be understood quickly and easily. This may be true even when administrative information systems exist. Mellor (1977) surveyed school superintendents who had access to a comprehensive computer-based information system that contained information on their districts' students, staff, curriculum, property, and finances. Although the system could support non-routine inquiries to provide an "interactive" problem-solving strategy, superintendents reported that the system did not meet their needs for information regarding several areas of decision priority, including curriculum development, program evaluation, district objectives, or teacher performance.

However, there are other reasons why district-level administrators and board members appear not to use systematic information in their deliberations. Kennedy (1982) found that educational policy makers often had difficulty agreeing about what a piece of new information meant or what its implications for policy were, and could not use it in their decision making until they had imbued the information with a meaning that they could all accept, often after having taken great liberties in interpretation. Kennedy also found that evidence (i.e., new, systematic information in the form of program evaluations) was often ignored and rarely had any impact independent of the political dynamics of the situation:

> In all cases, the studies' interpretations, and consequently their uses, were determined by the prevailing views of decision makers, and these in turn were molded by political, social, or organizational participatory processes. Even when the evidence appeared to provoke immediate reactions, the decision makers were not moved by clear and compelling evidence of a need for change. Instead, they rendered the evidence meaningful to their views, and only thereby did they perceive a need for change (p. 100).

The policy context is one in which values and judgments supersede rational decision criteria. Social problems are rarely defined in unambiguous terms, and information about social problems rarely carries with it an automatic solution (Sproull and Zubrow, 1981), so information does not enable policy makers to avoid the political process of resolving value issues. In such a context, decision makers' own judgments, or the opinions of trusted others, are valuable sources of information (Glasman, 1979).

If district-level administrators, particularly superintendents, develop a commitment to the use of systematic information about students and programs, they can influence the use of such information by others in the district, but only under certain conditions. In the early 1980s, the Center for the Study of Evaluation at UCLA began a project to develop and implement a model multipurpose evaluation system, with a comprehensive data base and data management system, that could be used for local educational decision making. The project was implemented in five school districts. In a paper describing aspects of the project's implementation, Sokoloff (1987) reported that when district leaders stressed the use of the evaluation system as part of a larger strategic initiative, such as a district-wide mastery learning project or staff development effort, principals and teachers were more likely to use the system and to trust the data it generated. This was true even when using the system was only a marginal aspect of the larger initiative. However, Sokoloff also found that it was imperative that district leaders provide concrete support for others' use of the

evaluation system, for example, by forming project teams or by enabling principals and teachers to attend project meetings during the regular school day.

The limited literature on the use of information by school board members and district-level administrators suggests that such individuals work in situations in which many issues are competing for their immediate attention and in which there is limited time for thinking and planning. Under these conditions, individuals are more likely to rely upon information that is more embedded in the political context in which actions are taken. More specifically, the following patterns appear to characterize the use of information by school board members and district-level administrators:

1. School board members and district-level administrators are more likely to value and use information that is linked to the political context in which they operate. Their use of information increases:

a. when information is informal and incorporates the opinions and judgments of key individuals in the situation;

b. when information is linked to or coupled with some agreed-upon interpretation of its meaning;

c. when information can be acquired in the course of other administrative activities;

d. when information can support non-routine inquiries that arise in the context of the situation; and

e. when information is linked to some strategic initiative or action.

2. School board members and district-level administrators are more likely to rely upon values and judgments than rational decision making supported by systematic information.

a. They value opinions about a particular practice more than data on the outcomes of the practice.

b. The more important the decision, the greater their reliance on opinions.

The Use of Information by Principals and Building-Level Administrators

Building-level administrators are faced with problems and decision situations which differ significantly from those of district-level leaders. They must not only make strategic planning and policy decisions, but also manage day-to-day operational problems of school functioning. Their patterns of information needs and information use are therefore likely to differ from district-level administrators. Unfortunately, as with district-level administrators, there is very little descriptive evidence available on how principals use information for problem-solving or on the effectiveness of different patterns of information use.

The ways in which building-level or programmatic administrators obtain and use information are determined in part by structural constraints of the managerial job. Sproull (1981) studied five "successful" managers of educational innovations, including one principal and one head teacher. She found that the managers' workdays were filled with many brief episodes of unscheduled and unpredictable verbal interactions with others, initiated as much by other persons as by the managers themselves. The managers devoted only about twelve percent of their work time to issues related to teaching and learning. They received information quickly and usually in verbal form, and there was rarely any redundancy in the information they attended to; that is, they tended to read or hear information only once. These structural conditions lend themselves to patterns of information acquisition that are more informal and verbal than in-depth and systematic. Thus, for example, principals learn about problems in their schools by asking staff or students they meet in the hall how things are going; they assess teacher performance in part through non-representative anecdotal evidence; and although they may read central office directives once, they rarely attend to them often enough or intensely enough to implement them exactly as intended (Sproull, 1981).

Much of the available literature on information usage by principals concerns principals' propensity to use quantitative data on student outcomes. Principals who are comfortable with such data, who trust them, and who are trained to interpret outcome data are more likely to use quantitative outcome data than their peers. Moreover, the images principals hold of themselves determines the extent of their information gathering and use.

It is important to distinguish between information gathering and information use, because collecting information does not by itself guarantee that such information will be used. Principals (and other school personnel) may not be able to make sense out of all of the data with which they are confronted. This is evident in Sokoloff's (1987) report on a project to develop comprehensive data base evaluation systems in several school districts. Sokoloff found that initially, principals and teachers involved in the project had difficulty specifying what variables they thought should be included in the system. They had difficulty formulating questions that might be answered with data, and also had trouble envisioning how data might translate into prescriptions for improvement. (District superintendents were more explicit about the information they wanted from the system, but some superintendents seemed to be fishing rather aimlessly through the data.) In another report on the same project, Herman (1987) described practitioners' errors and confusions in interpreting statistical information, including the failure to consider sample sizes or the validity of data at different units of analysis, and problems reading complicated displays of information.

Principals' use of statistical information such as achievement test data appears to be contingent on how comfortable they are with using data and on the extent of their training in social science methodology (Ligon, 1988; McColskey, Altschuld, and Lawton, 1985). Because most principals are not trained to interpret complex performance data, it is not surprising that they do not use such data extensively in their daily work. Most principals appear to want summary reports of means, medians, and percentages when reviewing school performance data, even when more detailed statistical information is available (Ligon, 1988). And principals make fewer errors of interpretation when they are provided with summary reports that show a "bottom line" than when they try to understand relatively raw data. This "preprocessing" of information, however, could decrease principals' sense of ownership of the results (Ligon, 1988). Ligon (1988) also noted that principals who distrusted the accuracy of quantitative information did not use it for problem-solving.

McColskey et al. (1985) found that principals' perceptions of themselves as instructional leaders were strongly related both to their use of formal sources of information, including program evaluation results and achievement test data, and informal sources of information such as personal conversations. Principals who considered themselves goal-oriented and who used their leadership roles to initiate goal-driven programs used more information in their decision making processes than did less proactive and less goal-focused principals. This study was unable to determine, however, whether principals' self-perceptions influenced their information seeking and usage, or whether principals' information usage shaped their self-perceptions as goal-oriented or instructional leaders. In this sense, the study provides little guidance for developing strategies to increase principals' use of information.

There is a strong presumption that "knowledge is good," and that having more information enables individuals and organizations to solve problems more quickly and effectively. While this is true in theory, in practice the outcome depends as much on how information is used in problem-solving as on whether information is used. The use of quantitative outcome data in no way marks a principal as more successful or competent than his or her peers. Glasman (1985) surveyed elementary school principals' perceptions about their use of student achievement data to influence the creation of instructional objectives and subsequent student learning. He found that both principals nominated as "most effective" and "least effective" by their immediate supervisors had a strong orientation toward using student achieve-

ment data in program evaluation and management. Thus, the propensity of principals to use student outcome data does not necessarily lead to positive ratings of their performance.

The limited literature on the use of information by principals and building-level administrators suggests that the nature of the conditions under which such individuals work affects their use of information. More specifically:

1. Building-level administrators are more likely to value and use information that is consistent with their working conditions. They are more likely to use information:

a. when information is communicated verbally in face-to-face interactions;

b. when information is communicated quickly;

c. when information is accompanied by an interpretation; and

d. when information is consistent with their understanding of or orientation to their administrative role.

The Use of Information by Teachers

More than any other school personnel, teachers may have profound impacts on the school experiences and achievements of students, especially disadvantaged students. The choices that teachers make regarding the nature of instruction and the evaluation of student performance structure whether children have the opportunity to succeed in school. Teachers make decisions before instruction, to choose the content of instruction, the nature of instructional activities, the organization of instruction (i.e., grouping practices), and the mechanisms to evaluate student performance (Walter, 1984; Natriello, 1987). They make decisions during instruction, to respond to unpredictable sequences of events as they unfold; and after instruction, to evaluate student performance and the effectiveness of the instruction. Teachers also use information to make implicit decisions about their expectations for students and their attributions regarding student performance (Shulman, 1986). While others in a school or school district make decisions to organize buildings, schedules, graduation requirements, and so on, it is teachers who most often make decisions about individual students.

The primary normative model for how teachers make decisions is based on Tyler's objectives-based, or ends-means, approach. In this model, teachers are expected to organize instruction around a set of learning objectives that are based on student needs, the subject matter to be covered, and school or societal goals (Tyler, 1950; Walter, 1984). The diagnosis of student learning needs is an integral part of this process, and so a focus is on developing ways of assessing both initial student needs and evaluating whether instructional treatments result in objectives being met and new needs arising.

Research shows, however, that teachers rarely follow this normative model. Teachers may intend to consider needs and objectives rationally before planning and executing instruction, but they have the same limited capacity for processing information that all humans have, and they are further constrained by the lack of time for careful consideration of needs and objectives (Shavelson & Stern, 1981). Above all, teachers tend to consider only that information which is directly relevant to the decisions they must make (Stiggins, Conklin, and Bridgeford, 1986), and the Tylerian ends-means approach presumes the wrong starting point for many teacher decisions.

This is particularly true for planning decisions made prior to instruction or between rounds of instruction. A number of researchers (e.g., Clark & Joyce, 1981; Morine-Dershimer, 1978-79b; Shavelson & Stern, 1981; Stiggins, Conklin, & Bridgeford, 1986; and Zahorik, 1975) have found that teachers generally do not plan in terms of learning objectives, as suggested by the prevailing normative model, but instead plan in terms of curricular content to be covered and activities to be conducted. By planning activities and content, teachers attempt to make student behavior more predictable and reduce the strain and uncer-

tainty of the teaching task, and thereby to reduce their need to process information during instruction (Shavelson & Stern, 1981). These activity-focused plans often are based on teachers' past experiences; Yinger (1977) concluded that much teacher planning consisted of invoking routines for activity, instruction, or classroom management that were part of the teachers' repertoires. Experienced teachers tend to do less planning, apparently because it is easier for them to call up routines from their experiential base.

However, although teachers appear not to plan on the basis of learning objectives or students' diagnosed needs, they do use a wide range of information about students in the planning process. Teachers' verbal reports of their planning decisions do not explicitly include student ability or specific objectives as primary considerations, but their mental plans or images of the lesson they will teach often tend to reflect these concerns (Morine-Dershimer, 1978-79b). Shavelson and Stern (1981) summarized the findings of thirty studies of the types of information used by teachers for preactive, interactive, and evaluative decisions; they found that, in planning decisions, teachers used mostly academic cues about students but also considered social and personal information. Taylor (1970, cited in Clark & Peterson, 1986) found that teachers tend not to use evaluative information about students in their planning of course syllabi (nor do they consider how their courses fit into the overall curriculum), but they do consider whether the activities being planned are likely to interest and involve students. The research on tracking and ability grouping for secondary students indicates that a variety of factors relating to students' social and academic backgrounds are considered in planning students' course placements (Alexander & McDill, 1976; Low, 1988).

Morine-Dershimer (1978-79a) found that the content of teachers' perceptions of students -- or the information about students to which they attended -- changed as the school year progressed and their planning tasks changed. In the fall, teachers focused on pupil personality, seemingly because teachers were preoccupied with creating a well-functioning social group from an assortment of individuals in a class. In November, when the instructional program was well underway and teachers were concerned with maintaining the pace of instruction, the focus was on students' involvement in instruction; and in June, when teachers were concerned with year-end assessments of students and plans for the following year, information on student growth and peer relations (i.e., academic and social development) was most salient. At no time did teachers report that ability or achievement was the dominant student characteristic to which they paid attention.

Teachers derive information about individual students from a variety of sources, and consider it within their own larger body of knowledge. Dorr-Bremme (1983) found that for start-of-year planning, teachers reported using insights from their previous teaching experiences most often (99% of English teachers used this, 97% of math teachers), students' standardized or minimum competency test scores next most often (30% of English teachers and 48% of math teachers), and previous teachers' comments and grades somewhat less often (only 28% of English and 29% of math teachers). For initial student placement or grouping, a teacher's own observations or tests were most commonly used, while previous teachers' reports were used much less often. The same was true for changing a student's placement during the school year. Dorr-Bremme argues that these behaviors are consistent with a clinical reasoning model, where a professional does not rely on one source of information primarily, but will weigh many different bits of information and arrive at a holistic assessment. No information is totally disregarded, and the objective is to arrive at a decision, not to wait for a "best" piece of information to be presented.

Teachers typically value their own assessments and observations more highly than information from any other source. In fact, teachers often discount other information provided to them because they believe so strongly in their own evaluations of student ability and performance (Stiggins, Conklin, & Bridgeford, 1986). Sokoloff (1987)

found that teachers judged statistical information about students against their own personal knowledge and, if they found an error in the statistical data, tended to discount the data entirely, even when they had originally supplied the information for the statistical database.

Teachers appear to vary in their preferences for different types of information about students and in the assessment techniques which they use to obtain information about students. High school teachers prefer teacher-made tests and more objective assessments of students, in contrast to elementary teachers, who rely more on curriculum-embedded tests and subjective observations and judgments. Math and science teachers appear to prefer more objective forms of assessment, while teachers who focus on writing and speaking skills rely more on observations and their own professional judgment in assessing students (cf. Herman & Dorr-Bremme, 1983, cited in Dorr-Bremme, 1983; Stiggins & Bridgeford, 1985). Low (1988) observed that teachers used varied criteria and information in making ability grouping decisions. These differences could be explained in part by teachers' different conceptions of the placement process (for example, whether they felt the goal was to challenge students or to ensure that they experience success) and by teachers' rankings of the relative importance of various student characteristics such as interest in the course, reading level, or home situations. Morine-Dershimer (1983) also observed that teachers' use of information about students was dependent on their perceived goals: teachers who cared more about manipulating grading practices in order to satisfy administrators behaved differently than did teachers who were more concerned with tying instruction to learning so that students could pass classes.

Teachers tend to make rapid judgments about the academic abilities and needs of their students, especially at the beginning of the year (Rist, 1970; Stiggins, Conklin, & Bridgeford, 1986). For the most part, these assessments are remarkably stable, although some research, particularly laboratory research, has suggested that teachers can alter their judgments on the basis of new information about students (e.g., Clark & Yinger, 1977). The speed with which teachers form judgments about students' abilities and needs calls into question the accuracy of these assessments, since they may be based on incomplete or inaccurate data or reasoning. Research on cognitive information processing has shown how individuals have a tendency to fix their early judgments, and then to select later information that corroborates their initial assessments (Snyder and Swann, 1978), or to use information-simplifying devices such as heuristics and attributions (Shavelson and Stern, 1981). Also, teachers may be using assessments of students that test only lower cognitive levels and that have been subjected to few quality controls or improvements (Stiggins, Conklin, & Bridgeford, 1986).

The evidence on the accuracy of teachers' judgments is mixed. Research on reading and learning disability specialists and on special educators has found significant inconsistencies and inaccuracies in professionals' judgments about student abilities and suggested educational placements (Stiggins, Conklin, & Bridgeford, 1986; Algozzine, Ysseldyke, & Hill, 1982). Misreadings of students' behavior due to a cultural mismatch between students and teachers can cause teachers to make erroneous judgments (Stiggins, Conklin, & Bridgeford, 1986). Teachers have been found to rate student attitudes and behavior more consistently with their academic performance than with students' own ratings of their personal characteristics (Khan, 1978). However, some studies show that teachers are able to predict student achievement test scores from their own assessments of students (Morine, 1976, cited in Clark & Yinger, 1977; Shavelson & Stern, 1981; Stiggins, Conklin, & Bridgeford, 1986). And other research has demonstrated that teachers' ratings of students' academically related personal characteristics were congruent with students' own self-ratings (Taylor, Whetstone, & Jackson, 1981).

Teachers consider information on individual students during instruction as well as in the planning and evaluation phases of their work. In their review of research on teachers' interactive thoughts

(i.e., thoughts during the teaching process), Clark and Peterson (1986) found that teachers considered instructional objectives only about 14% of the time, but about half of their thoughts while teaching had to do in one way or another with learners. In order to reduce their information-processing burden, high school teachers often select a "steering group" of students and gauge the progress of the entire class by how this steering group is doing and not by how all students are doing (Dahllof & Lundgren, 1970, cited in Clark & Peterson, 1986). Clark and Peterson (1981) found that teachers do not change their instructional routines unless things are going badly, as determined mainly on the basis of student behavior or involvement in class activities; they do not act to change instruction on less serious student cues. Again, this practice may be adaptive for teachers, since changing instructional routines during the course of instruction increases teachers' information processing loads and increases the potential for student management problems (Clark & Peterson, 1986).

Teachers must make instructional decisions constantly, perhaps as often as once every two minutes while teaching (Stiggins, Conklin, & Bridgeford, 1986). Given the rapid pace of interactive decision making, teachers cannot wait for information before making decisions (Dorr-Bremme, 1983), and tend to put a great deal of trust in the first-hand information that is readily available to them. Clark and Peterson (1986) found that teachers changing instructional routines during class considered information about students' social interactions and behavior more than academic information, with a markedly lower use of information about students' personal characteristics.

The type of planning which teachers engage in affects the kinds of information needed by teachers as they make interactive decisions. Morine-Dershimer (1978-79b) found that when there was a great deal of discrepancy between the lesson plan and what was actually happening in the classroom, teachers called on a broad spectrum of information about students, and often postponed decisions until a later time. Mild discrepancies resulted in teachers processing a fairly narrow band of information about student behavior during the lesson; little or no discrepancy resulted in teachers using established routines and previously developed images about students and the lesson.

Some of the planning decisions that teachers make also constrain other interactive teaching decisions. For example, Englert and Semmel (1983) found that teachers responded to student performance during reading lessons not just in terms of the performance itself, but also in terms of teachers' initial planning decisions about student ability and placement.

It is important to recall that the mere presence of information does not guarantee that it will have any impact. At times, information is useful to teachers, and hence becomes a basis for teacher behavior; but there also is ample evidence of instances in which information is not useful to teachers. As demonstrated in a wide range of research studies, the usefulness of information is affected by many different factors, including the accessibility and vividness of the information and the structural features of the information.

The amount of information available is generally not a predictor of use. For example, Algozzine, Ysseldyke, and Hill (1982) found that the amount of information reviewed by special educators had little effect on the accuracy of their decision making. Other researchers have demonstrated that increased amounts of information do increase individuals' confidence in their decisions, however (Schwenk, 1986).

In contrast to the amount of information, the accessibility of information does influence teachers' behaviors. Research that contrasts the importance of information quality with the importance of information availability has found that the availability of information overrides concerns about accuracy and quality (e.g., Taylor & Thompson, 1982; O'Reilly, 1982). Pauley and Cohen (1984) argue that the increased use of information leads to increases in the quality of information, but that the reverse is not necessarily true.

The use of information by teachers is determined at least in part by its "vividness" -- whether it is emotionally compelling, concrete, and close to a teacher's own experience in a spatial, temporal, or sensory way. Taylor and Thompson (1982) reviewed the research on vividness, and found that there was weak evidence for a vividness effect in studies where subjects received either vivid or non-vivid information. However, in an information-rich environment where individuals had to choose which information to attend to, vividness did have an impact on use. The effects of vividness appear also to depend on whether persons need the information or whether they hold prior opinions about it. Taylor and Thompson (1982) suggest that when individuals perceive information to be salient -- that is, when their attention is directed differentially to a piece of information -- that information holds more weight in later judgments.

Teachers are not typically trained in quantitative data analysis, and hence are unlikely to view quantitative or statistical information as vivid. It comes as no surprise, then, that research contrasting the usefulness of quantitative or statistical information versus qualitative or personalistic information has found that teachers, like other persons, perceive the latter to be more useful (e.g., Borgida & Nisbett, 1977; Sokoloff, 1987). Often teachers either discredit quantitative information because it contradicts what they know through personal experience or consider it trivial because it only repeats what they have learned in other ways. Sokoloff (1987) concluded that, at best, quantitative data might be used to alert teachers to various conditions, or to help them justify decisions they had already made, but it was not clear from his research that teachers would necessarily change practice on the basis of this source of information. Kennedy (1982) found very few instances where systematic evidence changed either teachers' working knowledge or their practice, even when it was made salient by being stressed by administrators and teachers were held accountable for making changes on the basis of it.

The structural features of information -- its clarity, format, scope, abstractness and continuity, as well as the media in which it is presented -- have been found to affect use in experimental circumstances and may also be important determinants of information use for teachers. Kiesler and Sproull (1982) refer to the consistency and clarity of information as its "signal-to-noise ratio." When information is clear, and there are no other sources of conflicting or competing information, the signal-to-noise ratio is high, and persons are able to perceive the information's message or signal. But when information must compete with other information that obscures the existence or meaning of the relevant information, the signal-to-noise ratio is low, and such information is not perceived by users. Educators increase the signal-to-noise ratio of evaluative information when they provide opportunities for teachers to consider such information without interruption (e.g., Sokoloff, 1987).

Cooley and Bickel (1986) argue that information provided to educators in a continuous flow is more likely to be used than is information that arrives infrequently or irregularly. Cooley and Bickel also argue for the importance of presenting information in a verbal, face-to-face interaction in addition to print formats.

Finally, Shangraw (1986) found that the media through which information is presented to potential users affected the likelihood that the information would be used. He found that computer-generated information was used differently than printed information; not surprisingly, persons with greater understanding of computers tended to trust and use computer-generated information more, and to have more confidence in decisions based on that information.

The literature on the use of information by teachers suggests that the conditions under which teachers work place special constraints on the way they use information. These conditions include a potentially large amount of information on the many students with whom teachers have con-

tact, and limited time away from immediate contact with students during which information might be processed and strategies developed for its use. Thus teachers confront a potentially overwhelming body of information with limited opportunities to process and use it. They react to this situation by using only the most salient information and by reducing their need for information and information processing.

This analysis leads to the following conclusions about the use of information by teachers:

1. Teachers tend to value and use information that is more salient to them. Conditions of greater saliency include:

a. when the information has been generated by the teachers themselves;

b. when the information confirms rather than contradicts their own experiences;

c. when the information is presented in face-to-face interaction;

d. when the information is presented in a continuous flow, as opposed to reports at long or irregular intervals;

e. when the information is more vivid; that is, when it is personalistic as opposed to quantitative, and when it pertains to social or behavioral events, as opposed to academic matters in the classroom;

f. when the format of information is consistent with the format of other information teachers typically receive;

g. when teachers perceive they need the information as a result of their orientation to the job of teaching; and

h. when the information is linked to immediate courses of action.

2. Teachers tend to reduce their need for information and information processing:

a. by relying on repertoires of routines that have proven successful in the past;

b. by using techniques that simplify the collection and processing of information (e.g., steering groups); and

c. by using only the most relevant or immediate information.

The Use of Information by Other School Staff

In addition to administrators and teachers, there are other personnel in high schools, including guidance counselors, school psychologists, social workers, paraprofessionals, and health workers, who work with students. These individuals make crucial decisions regarding students, by organizing and coordinating the services students receive, making placement decisions on students' behalfs, preselecting information that students need to know, and helping students make various choices and decisions. Such staff members work directly with students as their advisors or advocates, but also function as gatekeepers to further opportunities for students either within or outside the school (Erickson, 1975; Cicourel and Kitsuse; 1963; Fuchs and Fuchs, 1986b; Stern, 1982).

One can find many examples of the tests and other instruments that counselors, psychologists, and other support service staff use to gather information about student abilities, career interests, and so on, but there is almost no descriptive information available on how these staff use information about students in their work. The primary study of guidance counselors, Cicourel and Kitsuse (1963), demonstrated that guidance counselors' routine decisions had a strong effect on whether students went on to college and, by implication, on their future occupational choices. Cicourel and Kitsuse found that counselors made decisions about students on the basis of a diffuse set of criteria, including grade point average, teachers' comments, parental concerns, and student behavior. "Problem" students come to their attention in a variety of ways, including self-referral, referrals from teachers, counselors' own

assessment of students through personal observations or perusal of student records, or referrals from the principal. Counselors frequently sought information about students from other personnel in the school, as well as from parents and community contacts, to pinpoint more precisely the students' problems. However, while counselors were eager to obtain information from others, they were quite reluctant to share the information they had available.

In their study of a large-scale dropout prevention program, Grannis and Riehl (1990) and Grannis, Riehl, and Pallas (1987) found that non-instructional personnel hired by schools to work with at-risk students often had difficulty obtaining information that could identify which students were eligible for program services. Even after students had been enrolled in the program, teachers, guidance counselors, social workers, and other support staff exchanged information on students only infrequently and through informal mechanisms. And when support staff were able to obtain information about students' experiences in school, they often had no authority to intercede with teachers on behalf of the students. Support staff did have access to students' permanent records, report cards, and attendance files, but these sources could not provide information in a timely fashion. Some schools experimented with a case conference format, in which all staff members working with a particular student met to discuss the case. But staff reported that this procedure was too time-consuming: only a fraction of the program students could be discussed in case conferences, and there were virtually no opportunities for follow-up meetings about particular students.

Grannis and Riehl (1990) also found that support service staff sometimes worked at cross-purposes with each other and with teachers and administrators. For example, social workers trying to encourage students to attend school were not aware that students had been suspended; attendance personnel trying to decide whether students should be discharged did not know that other staff had already helped students enroll in trade schools or GED programs. Paraprofessionals often went to students' homes to meet with parents without obtaining enough information to inform parents of their children's school progress; further, they were unable to share with other school staff the outcomes of their encounters with parents.

Psychologists and counselors are often at the center of decision making activity regarding students with special needs, especially special education or limited-English-proficient students, because they often coordinate the effort to develop individualized educational programs (IEPs) for such students. Yet support staff often spend the bulk of their time doing test-based assessments, in part because they have not been trained to conduct other kinds of information-gathering activities such as classroom observations of students (Fuchs & Fuchs, 1986b; Ysseldyke & Marston, 1982). It has been suggested that counselors are in a unique position to use the IEP mechanism as the basis for a formative evaluation strategy incorporating continual assessment of students and a process of monitoring, recordkeeping, and consultation with teachers, parents, and students (Kuriloff & Robinson, 1982; Vacc, 1982).

Finally, the increasing use of computers in schools raises possibilities and concerns for support service staff. Counselors now have access to a number of computer-based tools for assessing students' vocational interests and aptitudes. Student information systems are changing the availability of information on students throughout the school building, creating the possibility that counselors can obtain and share information about students more efficiently (Wilton, 1982), but also raising concerns about confidentiality (Humphreys, Davidson, Feeney, Weintaub, & Manuel, 1986).

The literature on the use of information by guidance counselors and other school personnel is quite limited. Nevertheless, it does appear that individuals in such positions utilize a variety of kinds and sources of information on students. Additional research is needed to develop a more complete account of the pattern of information needs and uses among those in such positions.

Summary

Research on the use of information on students by school personnel reveals that patterns of usage are related to the working conditions of individuals in the various positions in the school system. District-level administrators are more likely to use information that is valued in the larger political context, building-level administrators are more likely to use information in forms that are consistent with the fast-paced interactions that characterize their day, and teachers are more likely to use information that is more salient amidst the wealth of information to which they are exposed, especially in light of their severe time constraints. If access to high quality information and sufficient time to interpret such information are prerequisites for better educational decision making, then there is cause for concern, as these necessary conditions are not met in the typical school.

The patterns of educators' use of information suggest that educators are accommodating their imperfect data and lack of time as best they can. They seek short-cuts for obtaining and interpreting information either by soliciting the opinions of others or by seeking information that is clearly linked to readily available actions. Teachers appear to rely upon repertoires of routines in which the information from past experiences is linked to patterns of activities that can be implemented without collecting and processing information on current students and their conditions. Such a strategy may work reasonably well when student conditions are relatively homogeneous and not subject to change. It is unlikely to work well in schools serving disadvantaged students where there is considerable variation among students and where conditions change quickly.

The predominant mode of reacting to the constraints that traditional educator roles place on the use of systematic information on students has been accommodation in the form of lower levels of information use and non-information-based decision making. Thus, there is only a small base of experience in adapting information and information systems to the needs of educators. Nevertheless, there have been a small number of deliberate attempts to improve problem solving in schools through the development of more appropriate information systems. These attempts provide additional insight into the potential for creating schools that are more responsive to the needs of students through the development of better information systems to support the work of educators.

Studies of Systematic Attempts to Improve the Availability and Use of Information on Students

In the preceding sections, we reviewed evidence about how policy makers, administrators, teachers, and other school staff typically use information, especially information about students, in their work. In this section, we describe some examples of the organization and use of information in schools that go beyond traditional practices, by redefining educator roles to include more information processing and/or by improving the quality of information available to educators. It is possible that such practices can be adapted in high schools serving disadvantaged students, enabling school staff to plan programs and activities that are more responsive to student needs. We consider approaches providing teachers and students with information on individual student performance, approaches providing educators with information on schools and programs more generally, and approaches that make use of integrated computerized databases.

Our examples in this section are illustrative, not exhaustive. We had little success in uncovering exemplary approaches that could realistically be labeled roaring successes. In several cases, the approaches have been implemented quite recently, and definitive evidence on their success or failure may not be available for several years. Due to the

lack of good evaluation evidence, we are cautious in highlighting such approaches, and our descriptions therefore are quite brief.

Approaches Providing Teachers and Students with Information on Individual Student Performance

We have seen that educators rarely plan around learning goals or objectives, even though that is the normative model for instructional planning. Instead, teachers focus first on content and activities, chosen on the basis of their ability to engage students, keep them involved, and ensure that they behave in predictable ways (Shavelson and Stern, 1981).

A number of schools are maintaining the focus on such activities, but selecting those that maximize learning and not just behavioral compliance. For example, Fuchs and Fuchs (1986a) advocate an approach they call systematic formative evaluation, which consists of developing individualized programs empirically on the basis of what works so that students can meet goals. Fuchs and Fuchs performed a meta-analysis of 21 studies on the effects of systematic formative evaluation, primarily in the special education context, with systematic formative evaluation operationalized as curriculum-based data collection at least twice each week, leading to program modifications where necessary. Results showed that this approach significantly improved the school achievement of students who were predominantly mildly handicapped, especially when combined with behavior modification.

Changes in information-usage practices generated through this approach led to more powerful effects on students. For example, one rule required teachers to change instruction after a student had performed lower than expected for three consecutive weeks. When teachers were required by this rule to use data in this way, effect sizes were higher than when teachers simply used their judgment to decide if and when to change instructional activities. The data-processing techniques used by teachers also affected student performance. When teachers were required to graph student performance data, student achievement was higher than in the absence of this requirement. Graphing student performance may give teachers more accurate and frequent information and may enable them to provide more frequent performance feedback directly to students.

Some schools are trying to tighten the link between the activities they plan and students' learning needs by identifying those needs at shorter time intervals throughout the school year. For example, the Success for All program in Baltimore, an elementary school program for students at risk (Madden, Slavin, Karweit, and Livermon, 1989), uses frequent assessment as a main part of the intervention program. Every eight weeks, students are evaluated, and the project facilitator uses these evaluations to place students in tutoring, family intervention, or other services, or to make other modifications in students' programs. These eight-week assessments are the basis for an IAP (Individual Academic Plan) for each student. Another feature of the program is increased communication about students among staff: reading teachers and tutors exchange information on students' specific needs and meet regularly to coordinate their approaches with individual children.

Frequent assessment also is a key element of less comprehensive interventions. For example, Rubin and Spady (1984) describe an elementary school in which the specific learning achievements of students determine their placement and movement through the curriculum. Students in this school are not required to be enrolled in a class for a set period of time. In mathematics, for example, students are frequently tested to determine what they need to learn next, according to a set of objectives. A program coordinator, who knows what every mathematics teacher is teaching at any given time, is able to match the student with the class she or he needs at any given time. Students move around, selecting learning opportunities from all that are available.

Approaches that Provide Educators with Information on Schools and Programs

The systematic examination of program characteristics and outcomes, when completed in a timely way and reported carefully to school staff, can enable school personnel to use information in school problem-solving. The goal of this strategy is to increase the availability, quality, and vividness of research-based information about school practices, so that educators will be more inclined to use the information.

For example, transcript analysis has been identified as a research tool for local assessment and policy-making (Garet and DeLany, 1988). In an analysis of transcripts from five Illinois high schools (Murphy, Hull, & Walker, 1987), researchers compared academic versus non-academic course taking among the five schools, and across grade levels within schools. They broke course-taking patterns down by subject and by grade level, and also studied the sequencing of courses. Their analysis was felt to be most useful at the building level, because it referred to site- and student-specific issues, and was closely tied to practitioners' own experiential base while still providing new information. Transcript analysis can be used locally to ensure quality and equity among course-taking patterns for all students, and to assess the degree of curriculum coverage to which students are exposed.

Although evaluation usage has often been problematic, in recent years there has been increased activity within district- and university-based research and evaluation offices to provide information that is more directly useful to school personnel. Efforts to generate profiles or statistical snapshots of schools are one such activity, especially when they display information that school personnel have themselves requested (e.g., Blum & Butler, 1985). In Pittsburgh, research activities are based on a "monitoring and tailoring approach," where various indicators of educational performance are examined by researchers and practitioners on a continuous basis and changes in practice are made accordingly (Cooley, 1983; Cooley & Bickel, 1986). This approach was used to develop a comprehensive effort to improve the educational climate in seven elementary schools (Bickel, 1984), to plan and evaluate a remedial reading program for secondary students, and to conduct a district-wide needs assessment (Cooley & Bickel, 1986). Klausmeier (1982; 1985) and others worked with individual schools in Wisconsin to use assessment information explicitly in the development of school improvement efforts and individualized educational plans for students at the secondary level.

Approaches Based on Integrated Computerized Databases

Since both computer technology and administrative software packages for schools have become more affordable and available, schools have begun to use integrated databases for storing and manipulating information on students. Some systems are district-based information systems, housed on mainframe computer systems, while others are microcomputer-based and located within individual schools. Some systems are little more than computerized filing systems, but increasingly software is used that enables educators to maintain relational databases of student information. There are a growing number of customized commercial software packages available for such purposes, as well as integrated database packages which can be adapted for school use and programs written by school personnel themselves. These computer systems give educators a greatly enhanced ability to organize information on students so that it can be easily accessed and analyzed.

Descriptions of a number of computerized information systems are provided by Bank and Williams (1987). Most of them are at formative stages of development and have not yet realized their full potential. For example, Cannings and Polin (1987) describe a decentralized system that allows administrators to monitor student attendance and to schedule students for courses on the basis of their previous academic performance and their standardized test scores. At the time of writing, the system was operational for its intended

purposes, but teachers had not yet begun to use it as a source of information for their own decision making, possibly because they could not access the system directly but had to go through a counselor. Sirotnik and Burstein (1987) describe a computer information system that provided, among other benefits, a set of user-specified "at a glance" reports, on students, classes, and schools. Although teachers involved in designing the system were quite enthusiastic about all three report formats, they used only the "student-at-a-glance" report extensively.

Many of the conclusions drawn by those involved in prototype development of computerized information systems point to the need for adequate resources, training, and patience as these systems are developed. In spite of short-term frustrations, in most cases these developers see the information systems providing a window to the future, allowing for far more complex uses of information in problem-solving. For example, Williams and Bank (1984) describe the use of computerized information systems in two school districts, and conclude that differences in the use of the systems by school personnel had to do with whether the system informed significant decisions with real consequences, whether the school personnel trusted the validity of the data, and whether the system was compatible with the existing culture of the school. Cole (1987) described the prototype development of a decision support system in one school district and found that users did relate multiple data elements to each other, and did use longitudinal information. There thus appears to be reason for optimism that computerized information systems will enable school personnel to use information strategically (Bank and Williams, 1987).

These organized efforts to improve the use of student information in schools suggest that current practices in many schools can be modified to enhance the capacity of educators to use information to improve the educational process. In light of our review of the literature on the use of information by individuals in different positions, the process of implementing sophisticated student information systems that will be used by educators to improve their responsiveness to students is lengthy and potentially quite difficult. Designing such a system and refining it so that it is truly useful to teachers, counselors, and administrators is likely to require many iterations and a longer period of time than is customary in school improvement efforts. Moreover, a fundamental challenge in mounting such an effort is maintaining the interest and cooperation of educators in the early stages of the process when the information systems are just as likely to be frustrating as they are facilitating.

Conclusions

There is much to be gained by investing time and attention in the development of better and more useful student information systems. Studies of current patterns of information collection and utilization point to the barriers that educators confront in trying to obtain and employ information on students in carrying out their assigned tasks. Instead of pursuing unavailable or inaccessible information on students, educators must often develop strategies to do their jobs without such information. Consequently, many of the actions taken by teachers and other educators are not informed by the information necessary to make good decisions. Educators may resort to habitual patterns of activity, even in the face of changes in the student population being served. Because the presence of disadvantaged students in a school often means that the school staff must confront greater variability and greater instability, a greater proportion of the activity of educators in such schools may be poorly informed and inappropriate than in schools serving less disadvantaged and more stable populations. Schools serving disadvantaged youth may be particularly non-responsive to student needs.

Thus, the development of student information systems to support sophisticated and responsive educational problem-solving may be especially critical in schools serving disadvantaged students. Although previous research suggests that developing such systems will be difficult, it also provides some guidelines to make that development successful.

First, an information system designed to make educators more responsive to students must be closely linked to the various alternative courses of action that educators might pursue in their work. The traditional conception of information preceding action and action leading to new demands for information seems backwards. We may be more successful in encouraging utilization of information and responsiveness to student needs if we view information-action as a single unit in which the nature of the information affects the nature of the action, and the nature of the action influences the request for and interpretation of the information.

Second, it is clear that any information system must be congruent with the work lives of those who are to use it. It is, therefore, extremely important to study the various roles of educators in schools in order to develop information in forms and formats that support individuals in such roles. We cannot simply adopt approaches that might be attractive to researchers or developers.

Third, because educators have developed techniques for performing their tasks with far less than the ideal amount of information, we will be asking them to alter their work styles in major ways if we encourage them to base their activities on valid and complete information on students. This means that any attempt to alter the collection, organization, and utilization of information on students in a school represents a major change in the work of educators, how they perceive their work roles, and how they think while doing their jobs. Any such attempt is likely to be subject to serious resistance from educators. Some of this resistance can be overcome by the strength of the design of the information system, but much of it will only be overcome if the staff of a school come to view a new student information system as necessary to accomplish other broader goals such as restructuring the school or engaging in comprehensive school improvement.

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